

## PATENT COOPERATION TREATY

PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)



(PCT Article 36 and Rule 70)

PCT/JP2005/001284

REC'D 05 JUL 2006

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Applicant's or agent's file reference TY-F03031-00	<b>FOR FURTHER ACTION</b>	See Form PCT/PEA416
International application No. PCT/JP2005/001284	International filing date (day/month/year) 24.01.2005	Priority date (day/month/year) 30.01.2004
International Patent Classification (IPC) or national classification and IPC INV. C01G17/00 C01G7/00 C01F11/00 C01G55/00 C01G3/00 C01G5/00		
Applicant TOYOTA JIDOSHA KABUSHIKI KAISHA et al.		
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 8 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>		
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input checked="" type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input checked="" type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>		
Date of submission of the demand  13.12.2005	Date of completion of this report  04.07.2006	
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Arnotte, E  Telephone No. +49 89 2399-8573  	

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/JP2005/001284

## Box No. 1 Basis of the report

1. With regard to the **language**, this report is based on

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
  - ☐ international search (under Rules 12.3(a) and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4(a))
  - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

### Description, Pages

1-35 as originally filed

### Claims, Numbers

1-23 filed with the demand

### Drawings, Sheets

1-11 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☒ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☒ the claims, Nos. 1,3,12,14
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**International application No.  
PCT/JP2005/001284**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

- ☐ the entire international application,  
☒ claims Nos. 5-11,16-23

because:

- ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):
- ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):
- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed (*specify*).
- ☒ no international search report has been established for the said claims Nos. 5-11,16-23
- ☐ a meaningful opinion could not be formed without the sequence listing; the applicant did not, within the prescribed time limit:
- ☐ furnish a sequence listing on paper complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Preliminary Examining Authority in a form and manner acceptable to it.
- ☐ furnish a sequence listing in electronic form complying with the standard provided for in Annex C of the Administrative Instructions, and such listing was not available to the International Preliminary Examining Authority in a form and manner acceptable to it.
- ☐ pay the required late furnishing fee for the furnishing of a sequence listing in response to an invitation under Rules 13ter.1(a) or (b) and 13ter.2.
- ☐ a meaningful opinion could not be formed without the tables related to the sequence listings; the applicant did not, within the prescribed time limit, furnish such tables in electronic form complying with the technical requirements provided for in Annex C-bis of the Administrative Instructions, and such tables were not available to the International Preliminary Examining Authority in a form and manner acceptable to it.
- ☐ the tables related to the nucleotide and/or amino acid sequence listing, if in electronic form only, do not comply with the technical requirements provided for in Annex C-bis of the Administrative Instructions.
- ☒ See separate sheet for further details

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## Box No. IV Lack of unity of invention

1. ☒ In response to the invitation to restrict or pay additional fees, the applicant has, within the applicable time limit:
  - ☒ restricted the claims.
  - ☐ paid additional fees.
  - ☐ paid additional fees under protest and, where applicable, the protest fee.
  - ☐ paid additional fees under protest but the applicable protest fee was not paid.
  - ☐ neither restricted the claims nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is:
  - ☐ complied with.
  - ☒ not complied with for the following reasons:  
**see separate sheet**
4. Consequently, this report has been established in respect of the following parts of the international application:
  - ☐ all parts.
  - ☒ the parts relating to claims Nos. 2-4,12-15 .

## Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Yes: Claims	2,4,13,15
	No: Claims	
Inventive step (IS)	Yes: Claims	2,4,13,15
	No: Claims	
Industrial applicability (IA)	Yes: Claims	2,4,13,15
	No: Claims	

### 2. Citations and explanations (Rule 70.7):

**see separate sheet**

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**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

Reference is made to the following document/s/:

D1: Electronic structure of Si and Ge gold doped clathrates

D2: XP 002320444

D3: Structure and stability of Ba-Cu-Ge type I clathrates

D4: Superconductivity in germanium clathrate  $\text{Ba}_8\text{Ga}_{16}\text{Ge}_{30}$

D5: Nonstoichiometry and chemical purity effects in thermoelectric  $\text{Ba}_8\text{Ga}_{16}\text{Ge}_{30}$  clathrate.

D6: Structural, magnetic, thermal and transport properties of  $\text{X}_8\text{Ga}_{16}\text{Ge}_{30}$  (X= Eu, Sr, Ba) single crystals.

**Novelty****1/ Claims 1,3,12,15**

These claims have been canceled.

**2/ claims 2,4,13,15**

\*Claim 2 relates to a clathrate compound having the following formula:

$\text{Ba}_8 \text{Au}_b \text{Ga}_c \text{Ge}_{46-b-c}$  where  $5 \leq b \leq 16/3$ ,  $c = 16 - 3b$

\*Claim 4 relates to a clathrate compound having the following formula:

$\text{Ba}_8 \text{Au}_f \text{Ga}_{6-f} \text{Ge}_{40}$  where  $0 < f < 6$

D1 (abstract), D2 (page 4 line 28) disclose  $\text{Ba}_8 \text{Au}_6 \text{Ge}_{40}$ , and D3 (page 5535, "Introduction" line 3), D4 (Title), D5 (Title), D6 (Title), disclose  $\text{Ba}_8 \text{Ga}_{16} \text{Ge}_{30}$  but none of the documents of the search report explicitly disclose the compounds of present claims 2 and 4 so that these are regarded as being novel over the said prior art.

Consequently, the thermoelectric conversion elements comprising the compound of claims 2 or 4 are novel as well. Hence claims 13, 15 are novel over the said prior art.

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**Inventive step (claims 2, 4, 13, 15)**

On the one hand,  $\text{Ba}_8\text{Ga}_{16}\text{Ge}_{30}$  is disclosed by several documents, such as D3 (page 5535, "Introduction" line 3), D4 (Title), D5 (Title), D6 (Title), and on the other hand, it is common in the field of superconductors to dope compounds so as to modify their properties. (see for instance D5 page 7281 left column lines 7-9 disclosing the fact that compounds such as for instance  $\text{Ba}_8\text{Ga}_{16}\text{Ge}_{30}$  have been doped) D1 too, (see page 13245 right column line 2) discloses the Au-doping of -inter alia- Ge clathrates but remains rather vague in this respect.

However, a mere doping of  $\text{Ba}_8\text{Ga}_{16}\text{Ge}_{30}$  with Au will not necessarily lead to the compound of claim 2 (or claim 4) as the Ga content in  $\text{Ba}_8\text{Ga}_{16}\text{Ge}_{30}$  is significantly higher than in the compound of said claims 2,4.

It is therefore considered that the cited references taken alone or in combination one with another fail to specifically disclose a doping of  $\text{Ba}_8\text{Ga}_{16}\text{Ge}_{30}$  with Au that would results in the compounds of claims 2,4 and the therewith associated effects. Hence, the skilled practionner had no motivated reasons from the said references to perform such a doping.

Therefore, claims 2, 4 as well as 13,15 are regarded as being inventive over the said prior art.

**Unity**

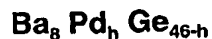
**Claim 2** relates to a clathrate compound having the following formula:



**Claim 5** relates to a clathrate compound having the following formula:



**Claim 6** relates to a clathrate compound having the following formula:



**Claim 8** relates to a clathrate compound having the following formula:

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$Ba_8 A_k Ga_l Si_{46-k-l}$  with A representing Pd or Pt

**Claim 9** relates to a clathrate compound having the following formula:

$Ba_8 E_m Ga_{6-m} Ge_{40}$  with E representing Cu or Ag

**Reasoning**

Claims 2,5,6,8,9 are all product claims relating to clathrates compound having different formulas.

The single common link between all these claims is the fact that they all relate to clathrates.

Nevertheless, clathrate compounds are well known (see for instance D1 disclosing

$Ba_8 Au_6 Ge_{40}$ )

Hence, the said link lacks novelty.

Consequently, claims 2,5,6,8,9 lack unity of invention.